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SMART PARKING: THE FUTURE OF SMART CITIES

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Abstract. The article examines the importance of incorporating smart parking as part of a smart city. With the advancement and widespread adoption of the Internet of Things, various aspects of society have been enhanced, resulting in an improved quality of life. Many cities worldwide are striving to become "smart cities." A popular initiative within smart cities is the implementation of smart parking solutions, which enable individuals to streamline their time management, decrease fuel consumption, and mitigate carbon dioxide emissions. Well-planned urban parking spaces are crucial for achieving sustainable urban development and have a positive impact on overall quality of life. This article focuses on the significance of considering the opinions of citizens and therefore conducts a questionnaire to evaluate the quality of urban parking spaces. Additionally, empirical research methods and a SWOT analysis are employed to identify strategic directions for the study. The article also examines successful case studies from foreign cities that have developed digital ecosystems for urban parking and explores the potential for adapting and localizing their experiences to enhance the smart parking concept in the city of Aktobe.

Key words. Smart parking, urban agglomeration, quality of life, smart city, urban parking spaces, innovation

Introduction. The global population is experiencing an exponential increase, resulting in a higher concentration of people in urban areas. This trend necessitates the exploration of new avenues for development and solutions that ensure a sustainable quality of life for city dwellers. It is projected that by 2050, 85% of the world's population will reside in cities, posing challenges in terms of infrastructure, resources, and pollution unless expedient and effective measures are implemented. This led to the emergence of smart cities, which aim to foster sustainable urban development. To delve deeper into this concept, smart cities refer to local governments that utilize information and communication technologies (ICT) to enhance operational efficiency, engage in effective public communication, and enhance public services while improving the well-being of citizens.

Although the precise definition may vary, the fundamental objective of a smart city is to optimize urban functions and stimulate economic growth, while simultaneously enhancing the

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quality of life for residents through the utilization of intelligent technologies and data analysis. Smart city technology facilitates the interaction between urban infrastructure and citizens, thereby optimizing services to enhance efficiency and enabling comprehensive city monitoring. As a result, it reduces overall costs, losses and resource consumption. And the best part is: this improves the quality of urban life, urban services and the working environment.

Who among you has not been annoyed at the wheel of a car, spinning around in search of a parking space in the city? According to a study by IBM (International Business Machines Corporation), 66% of people avoid trips to the city center because of parking problems. The real problem for many large cities, according to today's estimates, finding a place will cause at least 30% of urban congestion. To solve these new challenges, more and more cities are turning to intelligent parking systems.[1]

umanity has always strived for continuous improvement in its inventions. However, the recent obsession with making things "smart" or intelligent has gained traction, especially in the last two decades. Intelligence, which was once considered exclusive to living beings, is now prevalent in technology. Over time, everyday objects such as phones, televisions, clocks, lights, switches, etc. have become intelligent.

While this trend has been in the works for some time, it may be time to introduce intelligence into the parking process. By parking, we specifically refer to finding a parking spot on a public road, not in a private parking lot. Unlike other types of parking, this particular type presents unique challenges, as it lacks a controlled environment and introduces a whole new set of variables.

It is apparent, without extensive research and surveys, that the lack of available parking spaces is universally disliked. This dissatisfaction leads to wasted time, fuel, and patience, as people circle blocks in search of an empty spot, straining their necks and risking accidents while reversing. Although specific research on this issue may be scarce in Kazakhstan, several studies have shown the long search times and high traffic congestion caused by the search for parking spaces. Considering the problems faced by users and cities, it is evident that intelligent parking should aim to minimize unnecessary driving in search of a spot. Therefore, it is crucial to know where to park before reaching our destination. While this concept may seem simple in theory, it is challenging to put into practice.

Currently, intelligent parking is gaining popularity in developed countries, particularly through IoT (Internet of Things) based solutions. Many roads are now equipped with sensors that provide users with information about the number and location of available parking spaces. Other systems handle issues such as congestion management, license plate reading, and mobile app-based payment. These advancements lead to significant time savings for drivers, nearly halving the search

time for parking. The advantages are also visible from the point of view of the environment: urban pollution is 30% less.

However, intelligent parking in Kazakhstan covered only a few cities. Aktobe was not among these cities. To identify the problems and the concept of how parking spaces are used effectively, a survey was conducted among the citizens of the city. In the questionnaire, the questions were about the satisfaction of parking spaces in the city and the ability of city residents to pay extra for parking spaces.
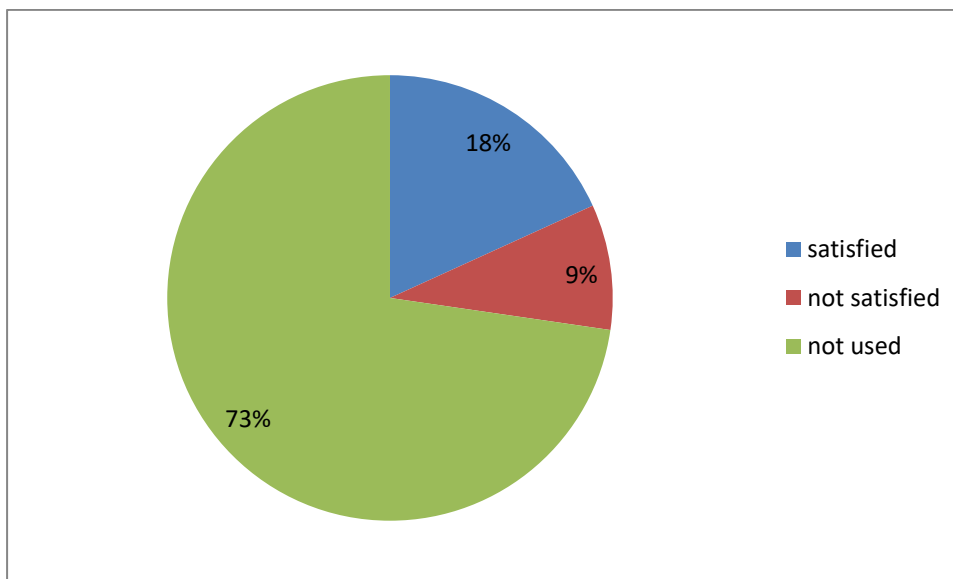

Figure 1 - How satisfied are the residents of the city with the number of parking spaces

Note: compiled by the authors on the basis of a questionnaire

According to the figure, it can be seen that more than half of the residents are not satisfied with the number of parking spaces. And every day the number of cars in the city increases, respectively, it is necessary to increase parking spaces, but when building it is necessary to use the concept of a smart city and digital technologies. As you know, smart parking requires large monetary investments and, accordingly, these parking lots become paid. And to find out if the residents of the city are willing to pay extra for such parking. We also turned to the questionnaire.

Figure 2 - Are the residents of the city ready to pay for a parking space

Note: compiled by the authors on the basis of a questionnaire.

As can be seen in the figure, 90% of respondents are willing to pay for smart parking. Based on the questionnaire, it can be concluded that the quantity and quality of available parking spaces do not meet the needs of residents. Therefore, it is necessary, first of all, to improve the existing parking spaces for the concept of smart parking, and secondly, to build new smart parking in places with a large accumulation of cars.

To find out the effectiveness of smart parking on the territory of the city of Aktobe, the analysis of "Strengths-weaknesses-opportunities-threats" (SWOT) is given below.

Strengths	Weaknesses
- Unique service offer	· High probability of malfunctions, glitches or bugs
· Can be expanded at national and global levels	· Large expenses for the creation of smart parking
· An innovative app that will make finding a parking spot fast, cheap and easy	
· Has no competitors in this city.	
Opportunities	**Threats**
- Expand at the national level	· Limited financial financing of the initial costs and the launch of the application
· Create a good and reliable service application and improve it as much as possible	· New competitors are likely to provide the same services in other cities.

· Population growth leading to an increase in the number of cars.	

Table 1 - SWOT analysis of smart parking efficiency in Aktobe city

Note: compiled by the authors

Based on the table, it can be concluded that the creation of smart parking in the territory of the city of Aktobe, although they have certain threats, will be effective in the future.

Conclusion. Due to the rapid growth of the urban population and unplanned urbanization, there is a reduction in the number of urban parking spaces and an increase in traffic jams. As a result, smart parking is becoming a subject of interest for both researchers and urban planners. In conclusion, it should be noted that the issue of parking in many large cities is among the important problems. And today we are seeing how the number of cars in the city of Aktobe is increasing every day, and the problem of parking is already on the agenda of local authorities. And to improve the quality of life of the population, local authorities and the business community should create and further implement the concept of smart parking.

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АҚЫЛДЫ ТҰРАҚ: АҚЫЛДЫ ҚАЛАЛАРДЫҢ БОЛАШАҒЫ

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Аннотация. Бұл мақалада смарт тұрақтарды смарт қаланың бөлігі ретінде қосудың маңыздылығы талқыланады. Заттар интернетінің дамуы және кеңінен қолданылуымен қоғамның әртүрлі аспектілері жақсара бастады, нәтижесінде өмір сапасы жақсарды. Әлемнің көптеген қалалары ақылды қалаларға айналуға ұмтылуда. Ақылды қалалардағы танымал бастама адамдарға уақытты оңтайландыруға, отын шығынын азайтуға және көміртегі шығарындыларын азайтуға мүмкіндік беретін ақылды тұрақ шешімдерін енгізу болып табылады. Жақсы жобаланған қалалық тұрақ орындары қаланың тұрақты дамуына қол жеткізу үшін маңызды және жалпы өмір сапасына оң әсер етеді. Ақылды тұрақ шешімдерін енгізу, өйткені олар адамдарға уақытты оңтайландыруға, отын шығынын және көмірқышқыл газының шығарындыларын азайтуға мүмкіндік береді. Жан-жақты, жетік жобаланған қалалық саябақ қаланың тұрақты дамуына қол жеткізудің ең жақсы тәсілдерінің бірі болып табылады және өмір сүру сапасын жақсартуға үлкен үлес қосады. Бұл мақалада азаматтардың пікірлерін ескерудің маңыздылығына ерекше назар аударылған, сондықтан қалалық автотұрақтардың сапасын бағалау үшін сауалнама жүргізіледі. Сонымен қатар, зерттеудің стратегиялық бағыттарын анықтау үшін эмпирикалық әдістер мен SWOT талдауы қолданылады. Сондай-ақ мақалада қалалық автотұрақтардың

цифрлық экожүйесін әзірлеген шетел қалаларының сәтті жағдайлары қарастырылып, Ақтөбе қаласындағы смарт тұрақ тұжырымдамасын жақсарту үшін олардың тәжірибесін бейімдеу және локализациялау әлеуеті зерттеледі**.**

Кілт сөздер: Ақылды тұрақ, қалалық агломерация, өмір сапасы, ақылды қала, қалалық тұрақ орындары, инновация.

УМНАЯ ПАРКОВКА: БУДУЩЕЕ УМНЫХ ГОРОДОВ

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Казахстан

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Аннотация. В данной статье рассматривается значимость включения смарт-парковки в состав умного города. С развитием и широким использованием интернета вещей различные аспекты общества стали улучшаться, что приводит к улучшению качества жизни. Многие города по всему миру стремятся стать "умными городами". Популярной инициативой в умных городах является внедрение решений в области смарт-парковки, которые позволяют людям оптимизировать управление временем, сократить потребление топлива и уменьшить выбросы углекислого газа. Хорошо спланированные городские парковочные места являются важным условием для достижения устойчивого развития городов и положительно влияют на общее качество жизни. В данной статье особое внимание уделяется значимости учета мнения граждан, поэтому проводится опрос для оценки качества городских парковочных мест. Кроме того, используются эмпирические методы и анализ SWOT для определения стратегических направлений исследования. Статья также рассматривает успешные кейсы из зарубежных городов, которые разработали цифровые экосистемы для городской парковки, и исследует потенциал адаптации и локализации их опыта для улучшения концепции смарт-парковки в городе Актобе.

Ключевые слова: Умная парковка, городская агломерация, качество жизни, умный город, городские парковочные места, инновация